Pepper

ATLANTIC PROVINCES VEGETABLE CROPS GUIDE TO PEST MANAGEMENT 2002 - 2003

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Introduction

Peppers are a member of the Solanaceae (night shade family). Capsicum annum is a native of the tropics and is related to many crop plants such as potatoes, tomatoes and eggplant. Peppers may be "hot" or "sweet". The fruit size varies from 1 to 30 cm in length, from thin to thick fleshed, conical to blocky or flattened, both yellow and green, at an immature stage, and with, red, yellow and brown mature fruits. This plant is a perennial in warm climates but grows as an annual in northern climates.

It is thought that all species of capsicum are of American origin. The centers of origin appear to be Mexico and/or Central America. When America was discovered peppers became adopted immediately and their use became worldwide.

Peppers are a long season, heat loving crop. This crop requires 3 to 4 months of frost free weather for good yields. They are very sensitive to frost and cold weather so are not generally transplanted until mid June. The minimum soil temperature for seed germination is 15°C with a maximum of 35°C and an optimum range of 18 to 35°C. Best growth and quality occurs at an optimum range of 21 to 24°C with a minimum of 18°C and a maximum of 26°C. Fruit set for many cultivars fail when temperatures drop below 13 to 18°C. At temperatures

above 32°C blossom drop becomes excessive. Large fruited cultivars tend to drop many of the flowers that form after several fruit have started to develop on the plant. Flowering will resume if these fruit are harvested and soil and weather conditions are favourable.

Only with the development of cultivars such as "Ace Hybrid" and "Super Set", has pepper growing in the field become a possibility. Peppers are mainly limited to the areas of the Atlantic provinces which can successfully grow grain corn.

Peppers require an adequate and regular supply of water. Well drained soils, well supplied with organic matter are required. Sandy loams and loams are optional. Sheltered fields with natural or artificial windbreaks are necessary.

High production is possible in unheated tunnel houses. Early cultivars may have some fruit by the 1st week in July and production can carry on until late October. Red peppers do not mature on cultivars such as "Super Set" until late August. In the field crops are highly variable in yield from year to year. 10,000 kg per hectare is thought to be a good field yield. In tunnel houses yields of 4.5 kg per square meter have been obtained (45,000 kg per hectare).

No sizable area of this crop is grown in the Atlantic Area. Tunnel houses are starting to show some promise for direct marketers. Due to the high capital costs of tunnels and the fluctuating wholesale prices of peppers it is not known whether wholesale markets could be economically developed. Specialty peppers such as yellow, hot, red, etc. may be grown for retail chain stores or the H.R.I. Trade.

Nutrient Content: Excellent source of Vitamin C. Good source of other vitamins and minerals including potassium. Low in calories - one medium raw pepper contains about 15 kilocalories.

Crop Establishment ▲ to Top

Seed Treatment - seed may be pelleted for mechanized greenhouse seeding (for transplant propagation).

Seeding/Planting - Peppers germinate and grow slowly so seed should be sown 9 to 10 weeks before field transplanting. Peppers must be started in a greenhouse or hot bed. The seed is sown in shallow flats of soil or soilless mix. A temperature of 27 to 29°C is required for good seed germination and steady plant growth. Approximately 200 g of seed is enough to produce 25,000 plants.

When the first leaves are about 1.5 cm long, transplant the seedlings to other flats containing a fertile compost soil. Space the plants 5 to 7 cm apart. Where space is available, transplanting to 8 to 10 cm plant container will produce larger plants with compact, well-developed root systems. These plants suffer less from transplanting shock.

Alternatively, plants can be raised by seeding raw or pregerminated seed directly into peat pots, multi-pot trays, wedge-shaped plant modules or directly into beds.

Such systems are less labor intensive, results in superior plant material raised in shorter time and reduces transplanting shock.

Pepper plants are hardened for about one week before transplanting to the field by reducing the soil moisture supply and maintaining a temperature of 13 to 16°C. Hardening of pepper plants gives resistance to wilting, but not to frost.

The number of flowers and fruits on the plants can be increased by exposing the seedlings to a controlled cold treatment, as follows:

1. Germinate seed at 27 to 29°C in flats of sterilized soil or whatever sterile medium is used for growing young seedlings.

2. When the third true leaf of the seedlings appears, grow the plants at a minimum night temperature range of 12 to 13°C for 4 weeks. The plants can receive the cold treatment either before or after the first transplanting. The plants should receive as much sunlight as possible.

3. After 4 weeks of cold treatment, grow the plants at the recommended temperature of 21°C. Transplant to the field only when the soil has warmed and the danger of frost is past (early to mid-June). In tunnel houses depending on supplemental heat, from early May to early June.

Space rows 60 to 75 cm apart, depending on equipment to be used. Space plants 40 to 45 cm in the row, approximately 25,000 plants per hectare required (more for tunnel houses).

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Black plastic mulch is effective for pepper production in controlling weeds around the plant and is often beneficial in obtaining higher early yields. Clear plastic mulches are more effective at warming the soil and promoting better growth but weeds under the plastic must be controlled with a herbicide.

Poor setting of fruit is usually the principal cause of low yields. Low night temperature (below 13 to 18°C) or extremely hot temperatures (in row tunnels or tunnel houses) are the principal causes of poor blossom set. Tarnished plant bugs also injure pepper flowers causing them to drop.

Drip irrigation is being used on this crop in combination with black plastic mulch in the field and tunnel houses.

Row tunnels can be used with this crop. They are labor intensive due to ventilation needs. Smaller growers with retail markets may be interested in this type of plasticulture.

Nutrition ▲ to Top

ALL ADDITION OF LIME AND FERTILIZER OR MANURES SHOULD BE

BASED ON RECOMMENDATIONS FROM A SOIL TEST.

Peppers respond to a good fertilization program with a continuous supply of plant nutrients but not a highly fertile soil.

Manure - may be applied and fertilizer rates adjusted.

Lime - may be applied to maintain the soil pH in the range 6.0 to 6.8.

Nitrogen - nitrogen is usually partly broadcast preplant along with the needed phosphorus. After some fruit is set, nitrogen can be sidedressed. Foliar sprays of urea may also be used. Up to 70 kg per hectare of actual nitrogen may be required in total. This has to be adjusted for application of manures and following legume sod.

Phosphorus - a starter solution high in phosphorus should be used at the time of transplanting. Band the phosphorus if mechanically possible. Use fields high in phosphorus.

Potash - peppers do not have a high requirement for potash. It would be best to broadcast and incorporate, before planting if needed.

Magnesium - a deficiency may occur if soil levels are low. Apply dolomitic lime prior to planting or apply foliar applications of magnesium sulphate (Epsom Salts).

Sulfur - apply gypsum if a deficiency is anticipated. This usually occurs on sandy soils low in organic matter where manures are not used. Gypsum is also a good source of calcium.

Micronutrients

Boron is not generally needed unless soil levels are low. Foliar spray(s) may be applied, if necessary.

Application method - At transplanting apply a starter solution high in phosphorus. Under high temperature conditions or in dry sandy soils reduce the amount of fertilizer by one half but use the same volume of water. This will reduce the risk of crop injury under these growing conditions. Broadcast some of the nitrogen and all of the phosphorus and potash before planting and work into the soil. If possible nitrogen should be sidedressed. Banding of large amounts of nitrogen and potash may injure this crop. In tunnel houses and fields fertilizer may be fed through trickle irrigation systems.

Pests and Pest Control ▲ to Top

Weeds

Perennial weeds must be controlled before planting. In the field preplant

incorporated herbicides may be applied to effectively control annual grasses and some broadleaved weeds. There are only a few available herbicides which provide fair weed control for use on peppers after transplanting and pre-emergence to annual weeds. These materials control annual grasses but only a small spectrum of annual broadleaf weeds. Cultivating and hoeing are necessary to control weed escapes from herbicide treatments. Black plastic mulch can be used in the field and tunnel houses to control weeds. Care must be taken to avoid fields where residual herbicides from the previous year persist in the soil, as crop injury may occur.

Diseases

Damping off (fungi)

Characteristics: Seed may decay, fail to emerge or once emerged develop water soaked discolored areas on the stems which withers and causes the plant to fall over. Disease incidence and severity is increased by cold temperatures, over watering, high humidity and over crowding.

Control: Apply a fungicide seed protectant. Plant seeds at recommended rate into sterilized seeding mix and flats. Supply adequate moisture but do not over water, and maintain night temperatures above 16°C. Drench immediately after planting with a fungicide. If damping-off occurs continue to apply fungicides at weekly intervals.

Verticillum Wilt (fungus)

Characteristics: Caused by a soil-borne organism that can survive in the soil for many years. Lower leaves yellow and wither, eventually whole plant may wilt and die.

Control: Grow seedlings in sterilized soil. Treat seed with fungicide. Avoid fields recently planted to pepper, tomato, potato or strawberry (a four year rotation). Do not plant before soil temperature has reached 16°C. Use resistant cultivars.

Bacterial Spot (bacterium)

Characteristics: Caused by a bacterium this disease affects both leaves and fruit. Leaf spots are up to 0.5 cm, gray-brown and often drop out causing leaves to look ragged. Fruit spots are raised and scab like. The disease is carried on the seed and spreads rapidly with continued wet weather.

Control: Sow hot water treated seed. Grow seedlings in sterilized soil and flats. On the first appearance of the disease, make several applications of fixed copper at label rates. Infected plants should not be set in the field. Follow at least a two year rotation and do not follow tomatoes.

Viruses

Peppers are susceptible to the same viruses which infect tomato. See control recommendation under that crop.

Insects

Cutworm

Characteristics: Cutworms are dull colored, soft-bodied caterpillars found at the base of plants, just under soil level. They feed on seedlings, cutting them off at soil level or just below.

Control: See Atlantic Provinces 'Guide to Pest Management' for details.

Aphids

Characteristics: Aphids are small, soft-bodied, slow-moving insects. They are often found in large colonies on the undersurface of leaves. A colony consists of winged and wingless adults and various sizes of nymphs. Aphids may be black, yellow or pink, but mostly are various shades of green. Aphids feed by sucking plant sap. Saliva injected while feeding may carry plant viruses or may be toxic to the host plant. Feeding by large numbers discolors foliage, curls leaves, and damages developing buds. The plants may be covered by a sticky substance, honey dew, which is excreted by the aphids.

Control: Transplant aphid free plants and use insecticides as needed. Good spray coverage is essential for adequate control.

Tarnished Plant Bug

Characteristics: Small 6 mm long insect, mottled white and yellow with touch of black on wings. Nymph is very small, greenish-yellow and marked with black dots on the thorax and abdomen. They overwinter under bark or leaf-litter, emerging early in the spring and feeding on weeds and fruit buds. After mating, eggs are laid of stems and petioles. Nymphs (yellowish-green, 1 mm long) emerge after 10 days, undergoing two molts to become adults within 3 to 4 weeks. Adults and nymphs are equally damaging; blossoms that have been injured drop, reducing fruit set.

Control: Apply insecticides when insects first appear. Repeat as necessary.

European Corn Borer

Characteristics: The European corn borer is a flesh colored caterpillar, 2.5 cm long with brown spots and a dark brown head. They are a problem in some areas, boring into the fruit of the pepper plant.

Control: Avoid planting near last year's crop field. Also avoid crop rotation with corn. Monitor insect levels with traps and spray when necessary.

Non-parasitic Disorders

Blossom-end Rot

Characteristics: A physiological disorder. Lack of adequate soil moisture (or the inability of the plant to take up water) and insufficient calcium uptake from the soil to the fruits during dry weather have been shown to cause this disorder. Excessive magnesium, potassium, sodium, or ammonium salts, or a deficiency or soluble calcium salts, all tend to decrease calcium uptake. Rapid early growth adds to the problem because it increases the need for calcium.

Control: Timely irrigation will reduce or prevent this disorder. If drought occurs and irrigation is not possible, cultivation should be very shallow to reduce water loss. Maintain high organic matter content in the soil and a high soil pH. Spray applications of calcium nitrate, or preplant applications of gypsum, may be useful if other control measures have not been successful.

SPECIFIC CONTROLS MAY BE FOUND IN THE "GUIDE TO PEST MANAGEMENT" FOR VEGETABLE CROPS.

Harvesting and Handling ▲ to Top

Sweet peppers are usually harvested as green fruit, but if left on the plant to ripen usually become red, while some cultivars are yellow when ripe. For best yield and quality, green peppers are harvested when they reach full size, are firm, and have thick flesh. This is shortly before they begin to change color. Some hot peppers are picked after they have changed color.

Harvest peppers twice a week to achieve maximum yields and pick by using a twisting, pulling motion with part of the stem adhering to the fruit.

Peppers can be brushed or washed before packing. If peppers are washed, wash water should be as warm as or slightly warmer than the peppers. Cold water washes reduce the temperature of the pepper and that of the air inside the fruit cavity. This creates a partial vacuum which draws some of the wash water (and bacteria) into the fruit. This infects the fruit with bacteria which can lead to subsequent breakdown.

Storage and Conditioning ▲ to Top

Peppers may be held about two weeks if quickly cooled with forced air, hydrocooling or vacuum, to 7 to 10°C and retained at 8 to 9°C. A high humidity of 95 to 98% is optimal. Packaging in polyethylene, sufficiently ventilated to prevent condensation is preferable to waxing. Some ripening occurs at 10 degrees C.

Chilling injury occurs at low temperatures. It requires about 2 days of 0°C, 7 days at 1°C, 14 days at 7°C to cause injury. The main symptom is surface pitting; that is, numerous shallow roundish depressions distributed over most of the green pepper fruit surface. Symptoms do not appear until several days at high

temperature after chilling, and are less in high humidity. Alternaria rot generally develops on injured tissue. Exposure of peppers to ethylene can stimulate ripening and senescence. Therefore, storage of peppers with apples, pears, tomatoes or other ethylene producing fruit should be avoided.

Bibliography ▲ to Top

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PEST	PESTICIDE (Formulation)	RATE Product	DAYS TO HARVEST	REMARKS ▲ to Top
Weeds ▲ to Top				
Preplant Perennial Weeds including quackgrass	ROUNDUP 356 Sn	2.5 to 7.0 L/ha	-	Apply in the fall or spring prior to planting. Annual weed control programs will be necessary to control weeds germinating after planting. For quackgrass control apply to actively growing quackgrass when at least 4 new leaves are present. The low rate (2.5 L/ha) will provide a minimum of one season control, while higher rates (4.75 to 7 L/ha) will provide longer term control. The low rate of Roundup should be applied in 50 to 100 L/ha water. If higher water volumes are used add a suitable surfactant. Wait 72 hours before plowing under. Best control of quackgrass is obtained when these herbicides are applied in the fall.
	TOUCHDOWN 480	2.5 to 7.0 L/ha	-	
	GLYFOS	2.5 to 7.0 L/ha	-	
	ROUNDUP TRANSORB	2.5 to 7.0 L/ha	-	
Preplant Incorporated Germinating annual grasses and some broadleaf weeds	TREFLAN 480	1.25 to 2.4 L/ha	-	Incorporate within 8 hours of application following label instructions. Ragweed and mustards are not controlled. Corn or cereal grains may be injured when planted in fields treated with trifluralin the previous year.
	RIVAL 60 DF	1.0 to 1.9 kg/ha	-	
	DEVRINOL 50 DF	2.24 to 4.5 kg/ha	-	Apply only one application per season.

Preemergence	DACTHAL 75 WP (no longer being manufactured)	9.0 to 15.5 kg/ha	-	Apply 2 weeks after transplanting but preemergence to the weeds. Cultivate to control escapes.
Insects ▲ to Top				
Cutworms			-	See: "Control of Wireworms, White Grubs, Cutworms and Slugs".
Aphids	THIODAN 4 EC	1.5 to 2.75 L/ha	2	
	THIODAN 50 WP	1.0 to 2.25 kg/ha	2	
	ENDOSULFAN 50 WP	1.1 kg/ha	2	
	DIAZINON 500 EC	0.55 to 1.1 L/ha	5	
	DIAZINON 50 WP	0.5 to 1.1 kg/ha	5	
	DZN 600EW	460 to 915 mL/ha		
	CYGON 480 EC	0.7 to 1 L/ha	3	
	DIMETHOATE 480 EC	0.7 to 1 L/ha	3	
	LAGON 480 EC	0.7 to 1 L/ha	3	
	PIRIMOR 50 WP	275 to 550 g/ha	3	
	PIRIMOR 50 DF	275 to 550 g/ha	3	
	ORTHENE SP	0.75 kg	7	Green Peach Aphid only. Orthene is systemic.
European corn borer	DECIS 2.5 EC	500-600 mL/ha	3	Do not use more than three times a year.
	DECIS 5.0 EC	250 to 300 mL/ha	3	
	SEVIN XLR PLUS	2.2 to 5.25 L/ha	2	
	SEVIN L 420 SU	2.75 to 5.5 L/ha	1	
Tarnished plant bug	SEVIN XLR 43 SU	2.5 to 5.25 L/ha	1	
	ORTHENE 75%	1.1 kg/ha	7	Orthene is systemic.
	SEVIN 85 WP	2.75 kg/ha	1	Apply when insects appear. Repeat as necessary. Aphid sprays will also control this pest.
	SEVIN 80 SP	3.0 kg/ha	1	
	SEVIN 50 WP	4.5 to 5.5 kg/ha	1	
	SEVIN XLR 43 SU	5.25 to 6.4 L/ha	1	
	SEVIN L 420 SU	5.25 to 6.4 L/ha	1	

Diseases

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Damping Off	CAPTAN 50 WP	125 to 225 g/100 m^2	-	Apply as a dust to soil or in 50 to 85 L of water per 100 m^2. Work into the upper 8 to 10 cm of soil before planting.
	CAPTAN 80 WP	1.5 kg/1000 L	-	Apply 50 to 85 L per 100 m^2. Work into upper 7.5 to 10 cm of soil before planting.
	MAESTRO 75 DF	1.5 kg/1000 L	-	
Early Blight Bacterial Spot		1.1 to 3.25 kg/ha	5	Apply at first sign of the disease and at 7 day intervals. Zineb will not control bacterial spot.
	FIXED COPPER	Follow manufacturer's directions	1	